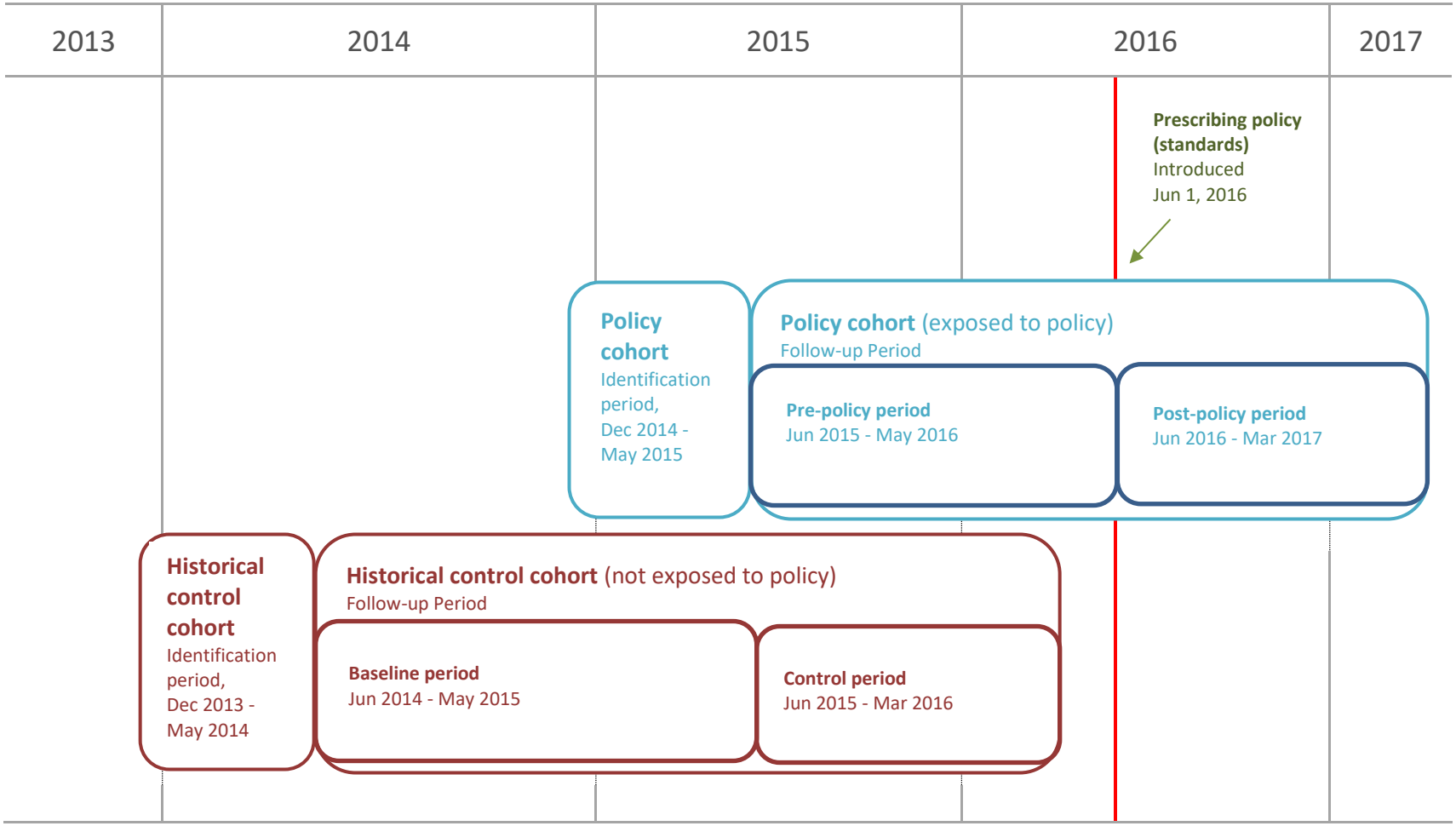
Appendix 1

A. Study design

Figure S1. Longitudinal cohort study design with cohort identification and follow-up periods for policy cohort and historical control cohort. Patients were selected for each cohort during a 6-month identification period. The policy cohort was followed for a 12-month pre-policy period and a 10-month post-policy period. Historical controls were followed for an analogous 12-month baseline period and 10-month control period, but not exposed to the policy.



B. Diagnostic codes for exclusions, outcomes and covariates

Table S1. Cancer diagnostic codes for exclusions

Description	ICD codes
ICD-9 codes:	
Malignant neoplasm of lip, oral cavity, and pharynx	140–149
Malignant neoplasm of digestive organs and peritoneum	150-159
Malignant neoplasm of respiratory and intrathoracic organs	160-165
Malignant neoplasm of bone, connective tissue, skin, and breast	170-175
Kaposi's sarcoma	176
Malignant neoplasm of genitourinary organs	179-189
Malignant neoplasm of other and unspecified sites	190-199
Malignant neoplasm of lymphatic and hematopoietic tissue	200-208
Neuroendocrine tumors	209
ICD-10 codes:	
Malignant neoplasms of lip, oral cavity and pharynx	C00-C14
Malignant neoplasms of digestive organs	C15-C26
Malignant neoplasms of respiratory and intrathoracic organs	C30-C39
Malignant neoplasms of bone and articular cartilage	C40-C41
Melanoma and other malignant neoplasms of skin	C43-C44
Malignant neoplasms of mesothelial and soft tissue	C45-C49
Malignant neoplasm of breast	C50
Malignant neoplasms of female genital organs	C51-C58
Malignant neoplasms of male genital organs	C60-C63
Malignant neoplasms of urinary tract	C64-C68
Malignant neoplasms of eye, brain and other parts of central nervous system	C69-72
Malignant neoplasms of thyroid and other endocrine glands	C73-C75
Malignant neoplasms of ill-defined, secondary and unspecified sites	C76-C80
Malignant neoplasms, stated or presumed to be primary, of lymphoid, haematopoietic and related tissue	C81-C96

Table S2. Opioid poisoning codes

Description	ICD-10 codes
Poisoning by opium	T40.0
Poisoning by heroin	T40.1
Poisoning by other opioids	T40.2
Poisoning by methadone	T40.3
Poisoning by synthetic opioids	T40.4
Poisoning by unspecified/other opioids	T40.6

Opioid poisoning definitions:

Opioid overdose hospitalization is defined as occurring on the date of hospital admission, when a hospital admission record is coded with an ICD-10 code opioid poisoning (**T40.0, T40.1, T40.2, T40.3, T40.4, or T40.6**) and the hospital diagnosis type is coded as M (most responsible diagnosis); 1 (pre-admit comorbidity); W, X or Y (service transfer diagnoses); or 6 (proxy most responsible diagnosis).

Opioid overdose death is defined as occurring on the date of death recorded in vital statistics data, when the death is accompanied by a cause of death coded with an ICD-10 code opioid poisoning (**T40.0, T40.1, T40.2, T40.3, T40.4, or T40.6**).

Table S3. Chronic non-cancer pain covariates

Chronic pain condition	Diagnostic codes (ICD-9, ICD-10)	Definition (algorithm)
Nociceptive pain:		
Mechanical neck and back problems (excluding low back pain)	ICD-9: 721.0, 721.1, 721.2, 721.3, 721.4, 721.5, 721.6, 721.7, 721.8, 721.9, 722.0, 722.1, 722.2, 722.3, 722.4, 722.5, 722.6, 722.7, 722.8, 722.9, 723.0, 723.1, 723.2, 723.3, 723.4, 723.5, 723.7, 723.8, 723.9, 737.1, 737.2, 738.2, 738.4, 738.5, 739.1, 739.2, 739.3, 739.4, 756.1, 846.0, 846.1, 846.2, 846.3, 846.8, 846.9, 847.0, 847.1, 847.2, 847.3, 847.9 ICD-10: M47, M48.1, M48.2, M48.3, M48.9	>=1 healthcare encounter with any of the ICD codes listed during previous 365 days [Adapted from an algorithm created by Lavis et al, 1998,[18] and validated by Lacasse et al, 2015][19]
Low back pain, mechanical	ICD-9: 724.0, 724.1, 724.2, 724.3, 724.5, 724.6, 724.8, 724.9, ICD-10: M43.2, M43.5, M48.0, M53.2, M53.8, M53.9, M54.5	>=1 healthcare encounter with any of the ICD codes listed during previous 365 days [Adapted from an algorithm validated by Lacasse et al, 2015]
Osteoarthritis	ICD-9: 715.00–715.99 ICD-10: M15, M16, M17, M18, M19	>=1 hospital admission or >=3 physician visits with any of the ICD codes listed during previous 365 days [Adaptation of an algorithm of Harrold et al, 2000,[20] who tested >=3 ambulatory visits]
Rheumatoid arthritis	ICD-9: 714 ICD-10: M05-M06	>=1 hospital admission or >=3 physician visits with any of the ICD codes listed during previous 365 days [Adaptation of algorithms of Widdifield et al, 2013,[21] who tested 1 hospitalization ever as one algorithm and >=3 physician visits as another algorithm]

Neuropathic pain:		
Diabetic neuropathy	ICD-9: 250.6, 357.2 ICD-10: E10.4, E11.4	>=1 hospital admission or >=2 physician visits with any of the ICD codes listed during previous 365 days [Cf. Dworkin et al, 2010;[22] Berger et al, 2003;[23] Kostev et al, 2014][24]
Peripheral neuropathy (excluding diabetic neuropathy)	ICD-9: 354.5, 356.0, 357.0, 357.1, 357.3, 357.4, 357.5, 357.6, 357.7, 357.8, 357.9 ICD-10: G58.7, G60.0, G61.0, G61.9, G63, G62.0, G62.1, G62.2, G62.8	>=1 hospital admission or >=2 physician visits with any of the ICD codes listed during previous 365 days [Adaptation of algorithm of Callaghan et al, 2015][25]
Lumbar radiculopathy	ICD-9: 724.4 ICD-10: M54.16	>=1 hospital admission or >=2 physician visits during previous 365 days [Adapted from Schoenfeld et al, 2012][26]

Table S4. Diagnostic codes for other covariates

Description	Subcategory (if applicable)	ICD codes
Opioid use disorder		ICD-9: 304.0 ICD-10: F11
Alcohol dependence or harmful use		ICD-9: 303 ICD-10: F10.1, F10.2
Psychiatric illness	Depression	ICD-9: 311, 296.2, 296.3 ICD-10: F32, F33
	Bipolar disorder/ mixed mania	ICD-9: 296.0, 296.1, 296.4, 296.9 ICD-10: F31
	Schizophrenia	ICD-9: 295 ICD-10: F20
	Personality disorders	ICD-9: 301 ICD-10: F60
	Other psychosis	ICD-9: 297 - 299 ICD-10: F21 – F29

C. Additional information on data sources

The British Columbia Ministry of Health and the British Columbia Vital Statistics Agency approved access to and use of British Columbia data. British Columbia data sources were as follows (www.popdata.bc.ca/data): British Columbia Ministry of Health [creator] (2017): Medical Services Plan (MSP) Payment Information File. BC Ministry of Health [publisher]. MOH (2017); British Columbia Ministry of Health [creator] (2017): PharmaNet. BC Ministry of Health [publisher]. Data Stewardship Committee (2017); Canadian Institute for Health Information [creator] (2017): Discharge Abstract Database (Hospital Separations). BC Ministry of Health [publisher]. MOH (2017); British Columbia Ministry of Health [creator] (2017): Consolidation File (MSP Registration & Premium Billing). BC Ministry of Health [publisher]. MOH (2017); BC Vital Statistics Agency [creator] (2017): Vital Statistics Deaths. BC Ministry of Health [publisher]. Vital Statistics Agency (2017).

Appendix to: Morrow RL, Bassett K, Wright JM, et al. Influence of opioid prescribing standards on health outcomes among patients with long-term opioid use: a longitudinal cohort study. *CMAJ Open* 2020. doi: 10.9778/cmajo.20190228.

D. Description of statistical analyses with additional detail

We estimated rate ratios for the effect of the opioid policies on health outcomes, using generalized linear models with a log link function, a Poisson error distribution and an autoregressive correlation structure. Data included multiple observations for most patients due to the longitudinal design with repeated measures and inclusion of some patients in both cohorts, so we used generalized estimating equations in regression models to adjust for clustering effects. In addition, we adjusted estimates by the patient-level covariates to control for confounding. We conducted analyses using SAS Enterprise Guide software, version 6.1.

Each statistical model included data for patients in the policy cohort and patients in the historical control cohort. We estimated rate ratios for changes to the level and trend of each outcome following the opioid prescribing standards and guidelines among patients in the policy cohort compared to the historical control cohort by including interactions in each model between cohort status (policy cohort vs historical control cohort) with level effect and trend effect variables. Each model included a binary cohort status variable to associate each observation of an individual with the appropriate cohort, which could differ for different observations of the same individual (if the individual entered both cohorts). In addition, models included a binary level effect variable to indicate the post-policy period, and a linear trend effect variable which incremented by one during the post-policy period; the same values were assigned to analogous periods for the historical control cohort. An interaction between cohort status and level effect in the model tested for level changes in rates of health outcomes, which represented a sudden change following the policy. An interaction between cohort status and trend effect in the model tested for trend (slope) changes, which represented a gradual change in rates of health outcomes occurring in each month of the post-policy period. (Figure S2 in the depicts potential level and

trend changes following a change in policy.) Models also included a monthly trend variable which incremented by one for each month of follow-up to control for outcome trends throughout the follow period.

Figure S2. Potential changes in event rate following a change in policy